

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 18 JAN 2006

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Applicant's or agent's file reference <b>WO 42387</b>	<b>FOR FURTHER ACTION</b>		See Form PCT/PEA416
International application No. <b>PCT/IB2004/003353</b>	International filing date (day/month/year) <b>14.10.2004</b> ✓	Priority date (day/month/year) <b>16.10.2003</b> ✓	
International Patent Classification (IPC) or national classification and IPC <b>F01N3/08</b>			
Applicant <b>TOYOTA JIDOSHA KABUSHIKI KAISHA et al.</b> ✓			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of 5 sheets, including this cover sheet. ✓ 3. This report is also accompanied by ANNEXES, comprising: a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 2 sheets, as follows: <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).			
4. This report contains indications relating to the following items: <div style="margin-left: 20px;"> <input checked="" type="checkbox"/> Box No. I      Basis of the opinion  <input type="checkbox"/> Box No. II     Priority  <input type="checkbox"/> Box No. III    Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  <input type="checkbox"/> Box No. IV    Lack of unity of invention  <input checked="" type="checkbox"/> Box No. V     Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement  <input checked="" type="checkbox"/> Box No. VI    Certain documents cited  <input checked="" type="checkbox"/> Box No. VII   Certain defects in the international application  <input type="checkbox"/> Box No. VIII   Certain observations on the international application                 </div>			
Date of submission of the demand  <b>03.05.2005</b> ✓	Date of completion of this report  <b>19.01.2006</b>		
Name and mailing address of the international preliminary examining authority:  <div style="display: flex; align-items: center;"> <div>                         European Patent Office - P.B. 5818 Patentlaan 2                          NL-2280 HV Rijswijk - Pays Bas                          Tel. +31 70 340 - 2040 Tx: 31 651 epo nl                          Fax: +31 70 340 - 3016                     </div> </div>		Authorized Officer  <b>Schmitter, T</b>  Telephone No. +31 70 340-1015	



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/B2004/003353

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-23 as originally filed

**Claims, Numbers**

1-5 received on 03.05.2005 with letter of 03.05.2005

**Drawings, Sheets**

1/5-5/5 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify):*
  - ☐ any table(s) related to sequence listing *(specify):*
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify):*
  - ☐ any table(s) related to sequence listing *(specify):*

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/B2004/003353

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	1-5
	No: Claims	
Inventive step (IS)	Yes: Claims	1-5
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-5
	No: Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

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**Box No. VI Certain documents cited**

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**1. Certain published documents (Rule 70.10)**

and /or

**2. Non-written disclosures (Rule 70.9)**

**see separate sheet**

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**Box No. VII Certain defects in the international application**

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The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

Reference is made to the following document:

D1: US-B1-6 216 448 (SCHNAIBEL EBERHARD ET AL) 17 April 2001 (2001-04-17)

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The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (in the wording of claim 1, the references in parentheses applying to this document) an exhaust gas control apparatus for an internal combustion engine, provided with a NOx storage/reduction catalyst (2a,2b) provided in an exhaust passage and which stores NOx in exhaust gas by at least one of adsorption and absorption when an air-fuel ratio of in-flowing exhaust gas is lean, and then reduces and purifies the stored NOx using reduction components in the exhaust gas when the air-fuel ratio of the in-flowing exhaust gas is rich, the apparatus comprising:  
an upstream side portion (2a) of a carrier of the NOx storage/reduction catalyst (2a,2b), which is positioned on an upstream side of an exhaust gas flow, and a downstream side portion (2b) of the carrier (2a, 2b) of the NOx storage/reduction catalyst (2a,2b), which is positioned on the downstream side of the exhaust gas flow, wherein the carrier (2a,2b) carries an oxygen storage component that absorbs oxygen in the exhaust gas when the air-fuel ratio of the exhaust gas is lean and releases the absorbed oxygen when the air-fuel ratio of the exhaust gas is rich, and the amount of the oxygen storage component on the upstream side portion (2a) of the carrier (2a,2b) is made less than the amount of the oxygen storage component on the downstream side portion (2b) of the carrier (2a,2b).

The subject-matter of claim 1 differs from this known exhaust gas control apparatus of D1 in that the NOx storage capacity of the upstream side portion (7a) of the carrier (7a, 7b) is made greater than the NOx storage capacity of the downstream side portion (7b) of the carrier (7a, 7b).

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as the reduction of the consumption of reducing agent used to reduce the stored NO<sub>x</sub> in the catalyst carrier.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

By increasing the NO<sub>x</sub> storage capacity of the upstream side of the carrier combined with a large oxygen storage capacity of the downstream side of the carrier, relatively large amount of NO<sub>x</sub> is stored in the upstream side and can be purified by a large amount of oxygen in the downstream side and therefore a relatively small amount of reducing agent is needed to reduce stored NO<sub>x</sub> (see description par. [0026]).

Claims 2 to 5 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**Re Item VII**

The document D1 should be cited and briefly discussed in the introduction of the description (Rule 5.1 (a)(ii) PCT).

Enclosure of May 3, 2005

Our ref.: WO 42387

PCT-Application No.: PCT/IB04/003353

Applicant: TOYOTA JIDOSHA KABUSHIKI KAISHA

**Amended claims 1 to 5**

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1. An exhaust gas control apparatus for an internal combustion engine, provided with a NOx storage/reduction catalyst (7) provided in an exhaust passage and which stores NOx in exhaust gas by at least one of adsorption and absorption when an air-fuel ratio of in-flowing exhaust gas is lean, and then reduces and purifies the stored NOx using reduction components in the exhaust gas when the air-fuel ratio of the in-flowing exhaust gas is rich, the apparatus comprising:

an upstream side portion (7a) of a carrier of the NOx storage/reduction catalyst (7), which is positioned on an upstream side of an exhaust gas flow, and a downstream side portion (7b) of the carrier (7a, 7b) of the NOx storage/reduction catalyst (7), which is positioned on the downstream side of the exhaust gas flow, wherein the carrier (7a, 7b) carries an oxygen storage component that absorbs oxygen in the exhaust gas when the air-fuel ratio of the exhaust gas is lean and releases the absorbed oxygen when the air-fuel ratio of the exhaust gas is rich, and the amount of the oxygen storage component on the upstream side portion (7a) of the carrier (7a, 7b) is made less than the amount of the oxygen storage component on the downstream side portion (7b) of the carrier (7a, 7b); characterized in that

a NOx storage capacity of the upstream side portion (7a) of the carrier (7a, 7b) is made greater than the NOx storage capacity of the downstream side portion (7b) of the carrier (7a, 7b).

2. The exhaust gas control apparatus according to claim 1, characterized in that the upstream side portion (7a) of the carrier (7a, 7b) and the downstream side portion (7b) of the carrier (7a, 7b) carry at least one of platinum, palladium and rhodium, and the NOx storage capacity of the upstream side portion (7a) of the carrier (7a, 7b) is made greater than the NOx storage capacity of the downstream side portion (7b) of the carrier (7a, 7b) by changing an amount of at least one of platinum, palladium and rhodium carried on the upstream side portion (7a) of the carrier (7a, 7b) and the downstream side portion (7b) of the carrier (7a, 7b).

3. The exhaust gas control apparatus according to claim 1 or 2, characterized in that the NOx storage capacity of the upstream side portion (7a) of the carrier (7a, 7b) is made greater than the NOx storage capacity of the downstream side portion (7b) of the carrier (7a, 7b) by changing at least one of a carrier cell shape, a carrier cell size, and a carrier cell number on the upstream side portion (7a) of the carrier (7a, 7b) and the downstream side portion (7b) of the carrier (7a, 7b).

4. The exhaust gas control apparatus according to one of the claims 1 to 3, characterized in that the upstream side portion (7a) of the carrier (7a, 7b) and the downstream side portion (7b) of the carrier (7a, 7b) are provided separately.

5. The exhaust gas control apparatus according to one of the claims 1 to 3, characterized in that the upstream side portion (7a) of the carrier (7a, 7b) and the downstream side portion (7b) of the carrier (7a, 7b) are provided integrally.